Trip Report
Nicaragua
March 7-17, 2010

Stephen Clarke
Forest Health Protection

The purpose of this trip was to provide training in pine bark beetle management and identification to foresters and forestry professionals in Nicaragua. The southern pine beetle (SPB), *Dendroctonus frontalis*, had caused significant mortality of pines in northern Nicaragua the previous decade. Forest Health Protection (FHP) and the Texas Forest Service (TFS) worked with INAFOR (Instituto Nacional Forestal) to suppress the outbreak, and cooperation among the agencies has continued. In addition to SPB, a new species of *Dendroctonus* bark beetle which had previously been reported from southern Mexico to Honduras was recently found in Nicaragua, so our visit provided an opportunity to collect specimens.

Roger Menard, FHP pathologist, and Ron Billings, TFS entomologist, accompanied me on the trip. Both have had extensive experience working in Nicaragua. Our sponsor was Alberto Sediles, forest entomology professor with the Universidad Nacional Agraria (UNA). Alberto had requested the training, and he was instrumental in organizing the local arrangements and soliciting participants. Alberto picked us up at the Managua airport on March 7. We met Dr. Fidel Rojas, a forest health specialist with the Universidad de Pinar del Rio in Cuba, who had arrived earlier that day. Alberto is pursuing his Ph.D., and Dr. Rojas is his major professor.

We first stopped by Alberto's office at UNA to drop off some of the supplies we had brought for the taxonomy course; then went to Tip Top, a fast food restaurant, for a fried chicken lunch. We also sampled a local beverage called Toña, which we continued to sample throughout the trip in an effort to support the local economy. After lunch we headed north on the Pan-American highway to Estelí, the site of the bark beetle management training. It was the dry season, and the countryside was brown and dusty. In Estelí we stayed at Hotel Panorama, which had a lovely view of the highway.

The next morning, after a delicious breakfast of gallo pinto, scrambled eggs, cheese, and fried bananas, we drove to Tomabú National Reserve, just SE of Estelí. The higher elevations

of the Reserve were covered by pine forests, and scattered bark beetle activity was ongoing. We picked up Ishmael, who worked in the Reserve and knew the location of infestations. We spotted some red-topped pines and climbed up the hill to inspect. The forest floor was covered with pine needles, so the footing was slick. We discovered a small group of infested *Pinus oocarpa*. A couple of pines had pupae and brood adults, so we collected bark and placed it in zippered pillowcases to allow the adults to emerge. Further in the Reserve we found another area of bark beetle activity. We collected more bark, plus hung three Lindgren funnel traps. One trap was baited with frontalin, a primary pheromone of SPB. The second trap, located about 10 m away, was baited with *endo*-brevicomin, a synergist for the attractiveness of frontalin and also a pheromone for the new species. The third trap was baited with *Ips* pheromones, and hung near some recently-felled pines. We then hiked to a site where Alberto was conducting similar trapping, and we collected the trap catch. The *Ips* trap collection cup was full of beetles. On the way out of the Reserve, we picked up several locals and gave them a ride, as vehicles are scarce in the area. We also passed a moaning woman on the roadside who claimed she was dying, but we did not stay to see if her prognosis was correct. That evening Roger and I walked down to the Big Dog, and discovered that Toña conveniently could be purchased by the liter. Ron stayed at the hotel to work on his presentations, albeit with his eyes closed.

Alberto, Ron, and Roger looking for beetles

Ron teaching bark beetle management

The bark beetle management training began on Tuesday, and the classroom sessions lasted through Wednesday. The training was held at the Estlimar Science Park. There were 22 participants. Alberto gave an introduction and discussed bark beetle problems in Nicaragua. Fidel made a presentation on forest insect pests in Cuba. Ron handled a bulk of the training, discussing integrated pest management of bark beetles, including detection, ground evaluation, suppression, and record-keeping. Ron brought copies of five different bark beetle management handbooks in Spanish for the trainees, as well as notebooks and pens. I gave a presentation on bark beetle prevention, and Roger discussed diseases of pines. Fidel mentioned that there have been problems in Cuba when coffee is underplanted among pines. Apparently the pesticides used on the coffee affect the mychorrhiza of the pines. Fortunately there are no known *Dendroctonus* bark beetles in Cuba. A spider monkey had escaped from its cage and was roaming around the Science Park. It spent some time observing us, no doubt wondering what type of lower life form it had encountered.

Monkeying around

Dendroctonus galleries

Back at the Panorama, Ron couldn't get into his room, so the clerk had to kick open the door. The water heater in Roger's shower exploded unexpectedly; at least that is what he claimed. I did not have that problem, as my heater never worked (unlike me). I collected emerging beetles from the pillowcases, and placed them in vials with hexane for 30 minutes for cuticular hydrocarbon testing. The vials were ~~smuggled~~ brought back to the U.S. for analysis by Brian Sullivan of the Southern Research Station.

Thursday was the field trip for the class. We returned to Tomabú National Reserve. At the first site, we discovered a crew cutting down the infested trees. They used a chainsaw to fell the trees; then machetes to delimb them. We spotted a backpack sprayer, and learned that they also planned to spray the trees with chlorpyrifos insecticide. It was good to know that SPB suppression was acceptable within the Reserve; however, the suppression techniques utilized probably were not effective at completely controlling expanding infestations. Foresters are not allowed to cut any uninfested trees, which rules out a buffer and often results in continued spot expansion. In addition, infested trees with green crowns generally were not treated, which fails to eliminate active pheromone sources and allows parent adults to reemerge and infest new trees. These practices are typical in Nicaragua, and we hope the management training may change the policies and lead to more effective suppression. The class collected beetles from the felled trees and examined the different brood stages. We supplied them with hand lenses and collecting vials.

Bark beetle management class

Examining beetle brood stages

We went to the second site and discovered that the infestation was also being suppressed. Some fresh attacks had not been treated, and the class flagged all standing, infested pines, using different colored flagging to differentiate between the fresh attacks and brood trees. We checked the funnel traps and found quite a few beetles in the frontalin trap, but few in the *endo*-brevicomin trap. Most of the bark beetles in the Reserve appeared to be SPB and not the new species, which could explain the trapping results. Surprisingly, only two beetles were collected

in the *Ips*-baited trap, presumably due to the *Ips tyographus* bait we used. We collected a few *D. approximatus*, a large bark beetle that attacks the base of pines.

Thursday evening we went to steakhouse with one of the local INAFOR foresters, Gines Calderón. The Black Angus beef was excellent. We then went to her house and met her dogs and her brother, a civil engineer for the city. Their family grows coffee, and Ron and Roger sampled some of their product. Cigar production is a large part of the economy in the area, and Ron was graciously given a box, which he accepted even though he doesn't smoke (cigars).

On Friday we headed north to Ocotal and then east to the pine forests outside of San Fernando. These forests had been decimated by the last SPB outbreak, and pine regeneration was coming back. Roger had been working in the area, examining unexplained pine mortality. Scattered trees were dead or dying. The foliage of symptomatic dying pines was yellow. We were able to find some *D. approximatus* attacking near the root collar, and they probably inoculated the pines with fungi. Other factors likely are involved in the observed pine mortality. Roger and Fidel attracted a lot of seed ticks, while Ron hosted the local chigger population. We visited a trapping site Alberto had set up for his dissertation work. He had five treatments: 1. frontalin and turpentine; 2. frontalin, turpentine, and *endo*-brevicomin; 3. *Ips* lure; 4. alcohol; and 5. blank. The traps were suspended from a wire strung between two pines.

Healthy (green), dying (yellow), and dead (red) pines

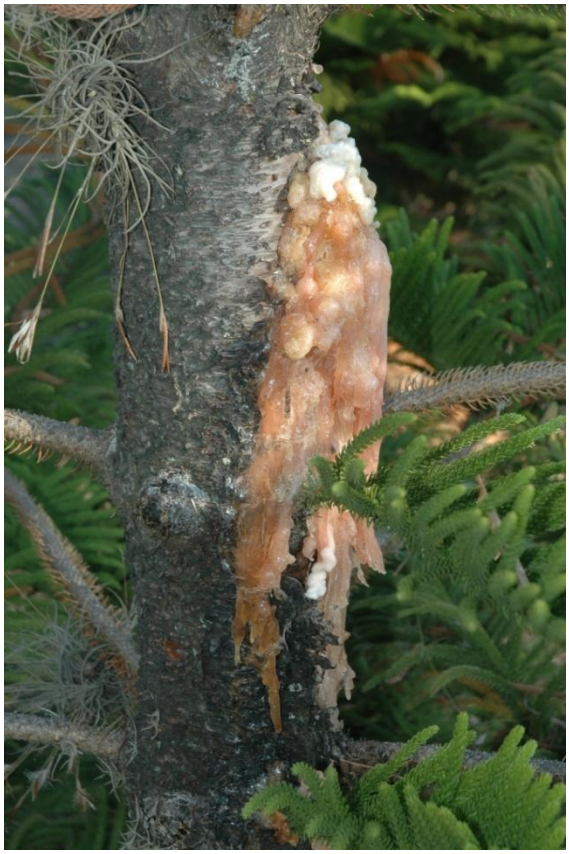
Seed ticks

We observed a couple of bark beetle attacks on the pines next to the trap with *endo*-brevicomin, and cautioned Alberto that this treatment should be at least 10 m from any potential host and that the traps should be separated by more than 100 m.

Funnel trap

Ron and Roger collecting beetles

On the trip back we collected three recently-cut pine bolts that had been infested by Ips bak beetles. These logs were taken back to Managua and placed in rearing cages. We also observed pines infested by pitch canker. We stopped and examined a large yard pine that had fading foliage. Resin was oozing from several points on the bark. Near the house we spotted an empty bottle of paraquat, which had been used to control vegetation around the yard. Alberto explained to the family that paraquat is not good for pines and to avoid its use near the tree in the future (if it survived). Next we stopped at a plantation of Norfolk pine outside of San Fernando. One of the pines had a very large glob of pitch on the bole, and it was full of a milky liquid. There was no indication of insect activity, and Roger suggested it was disease-related (being pathological, Roger was typically prone to attribute all damages to disease (Ron was typically just prone)). We spent the night in a small hotel in Ocotal, and were entertained all night by a group of college kids on spring break drinking cerveza on the roof.



Pitch mass on Norfolk pine

The next day we drove to Somoto, where we picked up some local foresters (many from the management training course). While waiting for Alberto, Ron and I observed the mating rituals of three blue-headed turkeys. From Somoto we travelled southwest San José de Cusmapa, accompanied by a police motorcycle escort (who later hit us up for gas money). We stopped to examine two infested pines in a field. One pine had brown foliage, and I placed infested bark in a pillowcase. The other tree lacked the apical dominance typical of pines, and had a short main bole, with many large branches. The branches and trunk had fresh bark beetle pitch tubes. The foliage fading was patchy, with some branches turning yellow and red, while others were still green. This pattern is rare for bark-beetle-infested pines. The beetles observed varied in size, and appeared to be a combination of SPB and the new species. We collected attacking beetles.

Saturday field trip to San José de Cusmapa

Bark beetle pitch tubes on large branch

After a stop in San José de Cusmapa to pick up even more people, we travelled to another pine forest with scattered bark beetle infestation. We purposely collected more infested bark and attacking beetles while unwittingly collecting more yearling ticks. After dropping everyone off at their appropriate stop, we headed back to Estelí. That evening we went back to the Calderón house for some nacatamales, a signature dish of Nicaragua. They were made at home by Gines, and they were excellent. After dinner, Roger and I visited the Estribo Bar. Estribo means stirrup or support, both of which were applicable, as the customers liked to stirrup trouble and required support when leaving. A mariachi band was playing in the front, competing with a loud jukebox in the rear. We met the owners and their "dates", all of whom had sampled a little too much of their stock.

Sunday we returned to Managua and checked into the Camino Real. Our original choice of hotel had been deemed as not secure by the Embassy (I guess it lacked a casino). We returned to Tip Top for lunch, and it proved to be really fast food, as the chicken spent only a minute amount of time inside Roger and me. As a result we weren't feeling tip top. Later I was able to collect more beetles that had emerged inside the pillowcases. Many of the beetles from the Somoto region appeared to be the new species, and I used them for the cuticular hydrocarbon analyses.

On Monday we met with Bob Rabaglia of FHP and Tom Atkinson of St. Edwards University. They were in Managua to conduct a three-day course on bark beetle identification. The training started on Tuesday and was held at the entomology lab at UNA. There were 15

participants, including two people from Honduras, Dr. Rojas from Cuba, and Alberto. We provided the trainees with collection boxes, insect pins, forceps, and a point punch. Tom provided most of the training, as he is fluent in Spanish and an expert in bark beetle taxonomy. The students examined specimens provided by Bob and Tom, bark beetles collected during our trip, plus any beetles they had brought to the course.

Roger and I returned to the U.S. on Wednesday. Ron assisted with the taxonomy course on Wednesday before traveling to the island of Ometepe Thursday. He returned to the U.S. Sunday.

I would like to thank Ron and Tom for volunteering their time. It was great to have two Spanish-speaking experts in bark beetles available to conduct the training. Their enthusiasm and knowledge were greatly appreciated by the students and fellow professionals.

Tom Atkinson (right) teaches the bark beetle taxonomy course
Bob Rabaglia, Dr. Fidel Rojas, and Alberto Sediles in back (L-R)

Agenda

Forest Pest Management in Central America, with Emphasis on Pine Bark Beetles

Instructors: Dr. Ronald F. Billings, Texas Forest Service; Dr. Stephen Clarke, U.S. Forest Service; Roger Menard, U.S. Forest Service; Alberto Sediles, Universidad Nacional Agraria

Tuesday, March 9

	Topic	Instructor
8:00 a.m.	Inauguration and welcome	
8:30 a.m.	General entomology	Sediles
9:30 a.m.	Forest pests in Cuba	Rojas
10:00 a.m.	Forest pests in Central America	Billings, Sediles
10:35 a.m.	Break	
10:45 a.m.	Forest pests in Central America (continued)	Billings, Sediles
12:00 noon	Lunch	
1:00 p.m.	Pine bark beetles: Identification and impacts	Billings
2:00 p.m.	Detection and monitoring bark beetles	Billings
3:00 p.m.	Ground evaluation of beetle infestations	Billings
3:00 p.m.	Break	
4:00 p.m.	Setting control priorities and reporting	Billings
4:30 p.m.	Questions	
5:00 p.m.	Adjourn	

Agenda, cont.

Forest Pest Management in Central America, with Emphasis on Pine Bark Beetles

Wednesday, March 10

8:00 a.m.	Direct control methods for bark beetles	Billings
9:00 a.m.	Hazard rating	Billings
10:00 a.m.	Break	
10:30 a.m.	Prevention of bark beetles	Clarke
12:00 noon	Lunch	
1:00 p.m.	On-going bark beetle research in Nicaragua	Sediles
2:00 p.m.	Review of the 1999-2001 *D. frontalis* outbreak in Nicaragua	Billings
3:00 p.m.	Break	
3:30 p.m.	Forest diseases and their management	Menard
4:15 p.m.	Questions	
4:45 p.m.	Closing ceremony with diplomas	
5:00 p.m.	Adjourn	

Thursday, March 11

Field trip to demonstrate identification, ground evaluation, and control methods of bark beetle infestations.